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10 May 1963

IN REPLY

REFER TO: 1/4/10-3549

Headquarters  
Ballistic Systems Division  
Air Force Systems Command  
Norton Air Force Base  
California

Attention: BSRPQ-1

Subject: Test Plan for Evaluation of Phase I RTS Attachment Bond System,  
Report Number MTO-858-1-3, dated 10 May 1963, Contract  
AF 04(694)-270; WS-133B, Minuteman Wing VI, Rocket Motor  
M-57A1

Reference: Exhibit "B," Paragraph IV.E

Gentlemen:

In accordance with Exhibit "B" to Contract AF 04(694)-270,  
one copy of the subject report is hereby submitted.

Very truly yours,

  
J. L. SHROUT, SUPERINTENDENT  
A. F. CONTRACT SUPPORT *for*

JRB:JLMORSE:dd

Encl. (Copy No. 1 of Report No. MTO-858-1-3)

cc: STL Representative  
Mail Stop 100-B (wo/encl)  
  
Mr. W. E. Howell (wo/encl)  
Wilmington

Mr. J. L. ShROUT (wo/encl)  
  
Mr. J. E. Greer (wo/encl)  
Wilmington

Technical Operating Report

B O B Approval No. \_\_\_\_\_

Contract Number AF 04(694)-270  
Exhibit B, Paragraph IV.E

TEST PLAN  
FOR  
EVALUATION OF  
PHASE I RTS ATTACHMENT  
BOND SYSTEM

(Sequence 1, Wing VI Structural Program)

Program Plan Section VII-C

MTO-858-1-3

10 May 1963

Prepared by

HERCULES POWDER COMPANY  
CHEMICAL PROPULSION DIVISION  
Bacchus Works  
Magna, Utah

Prepared for

HEADQUARTERS  
AIR FORCE SYSTEMS COMMAND  
UNITED STATES AIR FORCE  
Los Angeles, California

Report No. MTO-858-1-3

Copy No. 22


Date 10 May 1963

TEST PLAN  
FOR  
EVALUATION OF  
PHASE I RTS ATTACHMENT  
BOND SYSTEM

(Sequence 1, Wing VI Structural Program)

Approved by

  
W. L. Gutter  
Minuteman Project Manager

  
J. C. Farber  
Wing VI Project Superintendent

  
E. F. Shultz  
Minuteman Technical Superintendent

## FOREWORD

This test plan was prepared by authority of Contract AF 04(694)-270, Exhibit B, Paragraph IV.E, and in accordance with the effort outlined in Section VII-C of the Wing VI Program Plan. This test plan will be revised as necessary.

## SCOPE

The first test sequence of the Wing VI Structural Test Program is concerned with the evaluation and selection of a suitable bonding system for attachment of the Phase I Reverse Thrust package to the Stage III chamber.

Preparation and installation of the components are discussed and illustrated in this report. Hydrotest and pressurization sequence, pressure rate, and elapse time are presented. A Structural Design Test Report covering these tests will be issued upon completion of the tests.



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TEST PLAN FOR EVALUATION OF PHASE I RTS  
ATTACHMENT BOND SYSTEM

A. INTRODUCTION

The complete Wing VI Structural Test Plan is presented in Figure 1.

Test sequence #1 of the Wing VI Structural Test Program will consist of eight tests described below:

1. Tests 1 and 5 - Case P515Y.03

Test 1 utilizes 2 prototype glass pads bonded to the case with Armstrong A12T and a Buna-N rubber pad between the case and the glass pad. The case is hydrotested to test the bond. Test 5 utilizes 2 prototype pads bonded to the case with Shell Epon No. 937 without a rubber pad between the case and the glass pad. All 4 glass pads are bonded to the case prior to hydrotest. The tests are at ambient temperature.

2. Tests 2 and 7 - Case P615Y.03

Test 2 is a duplicate of test 1. Test 7 is a duplicate of test 5 except that the bonding material is Dow Corning Q-2-0103-2 adhesive. These tests are conducted at ambient temperature.

3. Tests 3 and 6 - Case P615Y.04

Test 3 is a duplicate of tests 1 and 2, except it is a hot test. Test 6 is a duplicate of test 5, except it is a hot test.

4. Tests 4 and 8 - Case P702.02

Test 4 is a duplicate of test 3. Test 8 is a duplicate of test 7, except it is a hot test.

B. OBJECTIVES

Test sequence #1 will be conducted for the purpose of obtaining data for evaluation of three bonding systems included in the Phase I Retro Rocket Backoff System (BOS) design concept. (Refer to figure 1 for detailed objectives.)

C. MATERIALS

The following materials will be needed for the first sequence of tests:

- (1) Number 181 weave glass cloth, per specification MIL-P-25421.
- (2) Epon 826 resin and CL catalyst Type I Class I, per specification MIL-R-9300.

SEQUENCE	TEST DESCRIPTION	TIME OF TEST										OBJECTIVES										REMARKS									
		TEST NO.	HYDROTEST	STRUCTURAL	FLIGHT AS3700T	AMOUNT	NOT	REFLECT WING BOLT	REFLECT WING BOLT	REFLECT WING BOLT	REFLECT WING BOLT	REFLECT WING BOLT	REFLECT WING BOLT	REFLECT WING BOLT	REFLECT WING BOLT	REFLECT WING BOLT	REFLECT WING BOLT	REFLECT WING BOLT	REFLECT WING BOLT	REFLECT WING BOLT	REFLECT WING BOLT	NOTES:									
1	BOND EVALUATION EVALUATION OF PRIMARY BOND SYSTEM	1	X																			1. TOTAL NUMBER OF SAMPLES = 8 CASES. 2. TOTAL NUMBER OF WING II CASES REQUIRED 3. INCLUDING SAMPLES. 4. TEST FUNDUS WILL UTILIZE WING II CASES 5. SAMPLES INCLUDED IN TOTAL WING II CASE COUNT.									
		2	X																												
		3	X																												
		4	X																												
		5	X																												
		6	X																												
2	EVALUATION OF ALTERNATE BOND SYSTEM NO. 1	7	X																												
		8	X																												
		9	X																												
		10	X																												
		11	X																												
		12	X																												
3	EVALUATE CASE 1 - WINGMAN FLIGHT CASES AT AMBIENT TEMP	13	X																												
		14	X																												
		15	X																												
		16	X																												
		17	X																												
		18	X																												
4	EVALUATE CASE 2 - WINGMAN FLIGHT CASES AT AMBIENT TEMP	19	X																												
		20	X																												
		21	X																												
		22	X																												
		23	X																												
		24	X																												
5	COMPARISON OF STRUCTURAL ADHERENT OF ALL-UP SYSTEM	25	X																												
		26	X																												
		27	X																												
		28	X																												
		29	X																												
		30	X																												
6	BACK UP EVALUATION OF PRIMARY BOND SYSTEM (TO BE COMPLETED IF REQUIRED)	31	X																												
		32	X																												
		33	X																												
		34	X																												
		35	X																												
		36	X																												
7	DETERMINE ULTIMATE PRESSURE CAPABILITY OF THE ALL-UP SYSTEM	37	X																												
		38	X																												
		39	X																												
		40	X																												
		41	X																												
		42	X																												

Figure 1. Wing VI Structural Test Plan

- (3) Buna-N rubber, Type I, per specification HPC-133-02-69A
- (4) Armstrong Al2T and activator B
- (5) Shell Epon 937 (Part A - resin, Part B - catalyst)
- (6) Dow Corning Q-2-0103-2 adhesive and QA-2-1011 primer with catalyst (SY.115)
- (7) FSU cases P515Y.03, P615.03, P615.04, and P702.02

#### D. FABRICATION TECHNIQUES

##### 1. Glass Pad

The glass pads shall be made as shown in Figure 2 by laying up ten layers of 181 glass cloth impregnated with Epon 826/CL resin system. The resin mix will consist of 100 parts by weight Epon 826 resin with  $14.5 \pm 0.5$  parts by weight CL catalyst. The pads will be cured as follows:

1 hr @ 120° F

2 hr @ 200° F

3 hr @ 300° F

##### 2. Rubber Pad

The rubber pads shall be cut from 1/16 in. thick stock. (See Figure 3.)

##### 3. Bonding System

The three bonding systems to be investigated will consist of the following combinations of the above materials.

a. Armstrong Al2T-4/2 mix-four parts B to two parts A with a 0.060 in. thick rubber pad.

b. Shell Epon 927 - 100 parts resin to 9 parts catalyst by weight. No rubber pad.

c. Dow Corning Q-2-0103-2 adhesive with QA-2-1011 primer - Use Q-2-0103-2 catalyst (XY-115) in a ratio of 10 parts catalyst by weight to 100 parts by weight of Q-2-0103-2 adhesive. No rubber pad.

##### 4. Glass Pad Bonding Preparation

Prepare the pads and cases for bonding as follows:

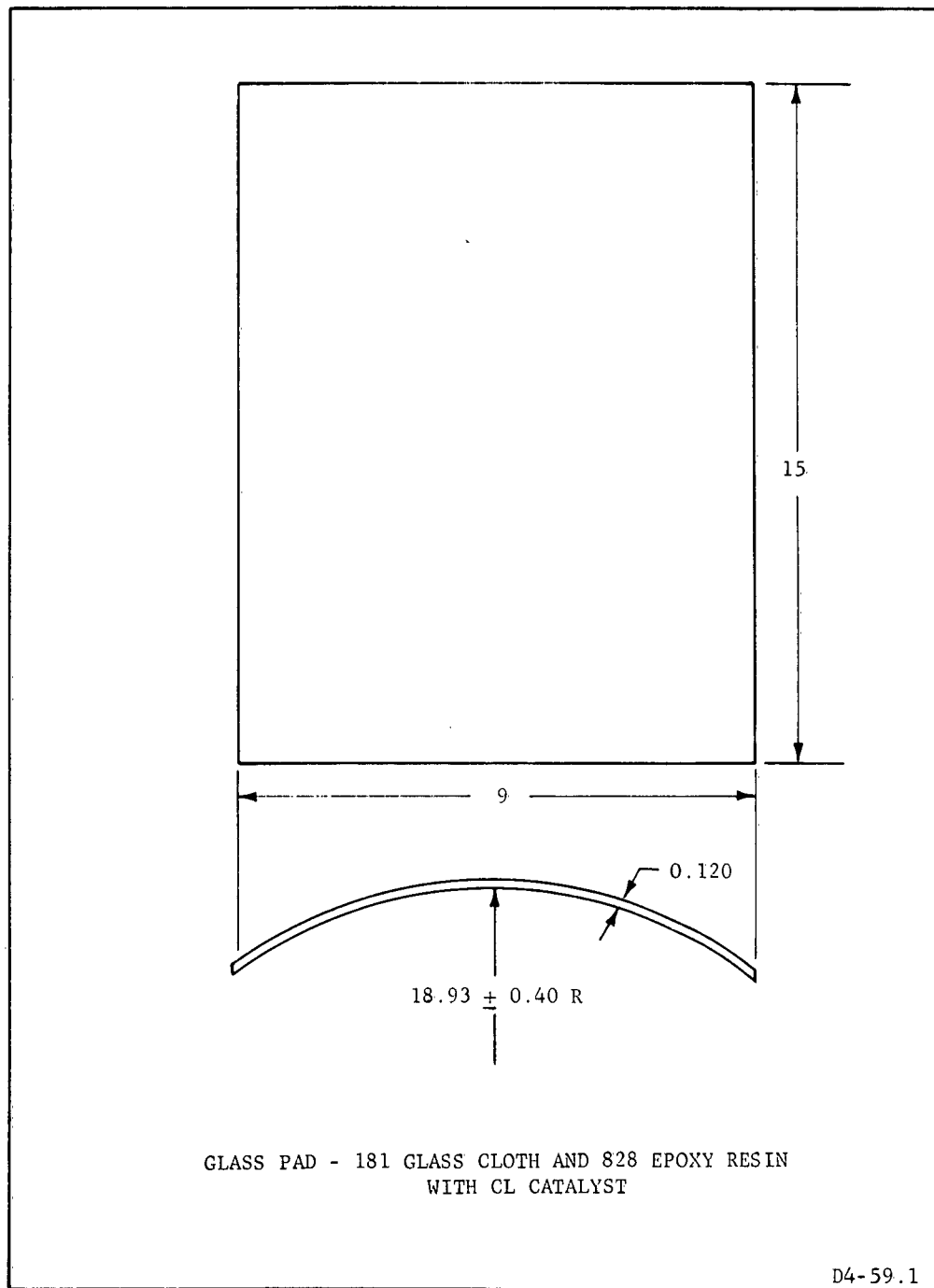
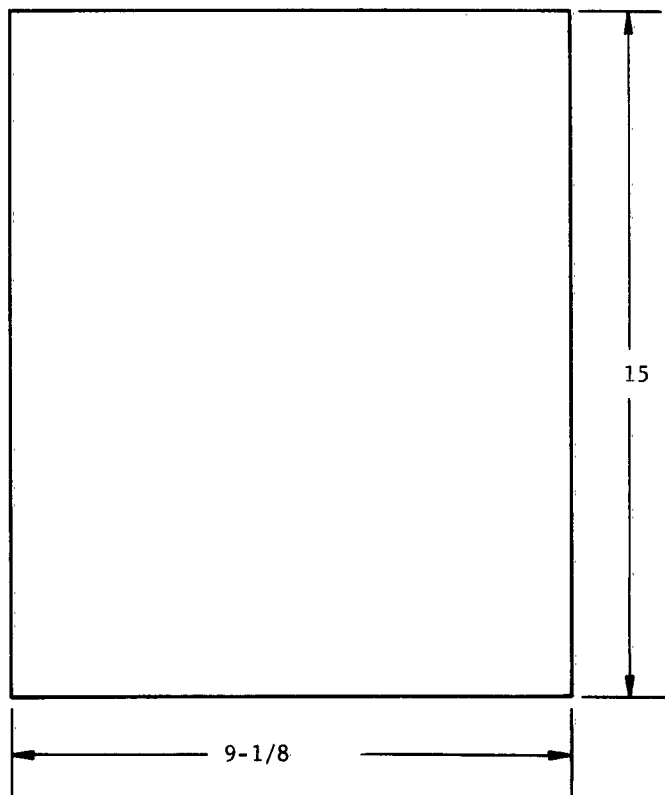


Figure 2. Glass Pad Details

RUBBER PAD - 1/16 IN. THICK BUNA N STOCK, 50-60  
DUROMETER, CALENDERED SURFACE PER  
HPC-133-02-2-69A SPECIFICATION,  
TYPE I. CALENDERED SURFACE TO BE  
COMPARABLE TO NYLON CLOTH, 8  $\pm$ 3 MILS  
THICK, 240 x 120 THDS/IN.



D4-59.2

Figure 3. Rubber Pad Details

- a. Degrease all surfaces of the glass pad with Quakersol. Make sure all parting agent is removed.
- b. Sand the side of the pad which goes toward the case with 100 grit sandpaper and degrease again with Quakersol.
- c. Lightly sand the Buna-N rubber pad on both sides and wipe with a clean dry cloth.
- d. Sand the area of the case where the pad is to be bonded with 100 grit sandpaper until the complete area is a lighter color and glaze on the resin is broken. Do not break the glass.
- e. Degrease the case sanded areas with Quakersol.

#### 5. Glass Pad Bonding Process

Locate the pads on the cases as shown in Figure 4. The pads are bonded to the case as follows:

- a. When using the Dow Corning adhesive system, the QA-2-1011 primer is applied prior to application of the adhesive system. The primer is cured at room temperature (70° - 80° F) for 30 min.
- b. Apply a layer of adhesive approximately 0.020 to 0.030 in. thick to the concave side of the glass pad and lay the Buna-N rubber pad over it. Smooth down the rubber pad so that complete contact is made.

#### Note

The rubber pad is used only with the Armstrong Al2T adhesive system.

- c. Apply additional adhesive to the concave side of the rubber pad which has been placed on the glass pad. This layer of adhesive should be spread on relatively thick (0.030 to 0.060 in.).
- d. Apply adhesive to the case in the sanded area in a thick layer (approximately 0.070 to 0.100 in. thick).
- e. Place the glass pad and rubber pad on the case in the proper position. (See Figure 4.)

#### Note

The layer of adhesive between the case and the rubber pad should be approximately 0.070 to 0.100 in. thick when cured.

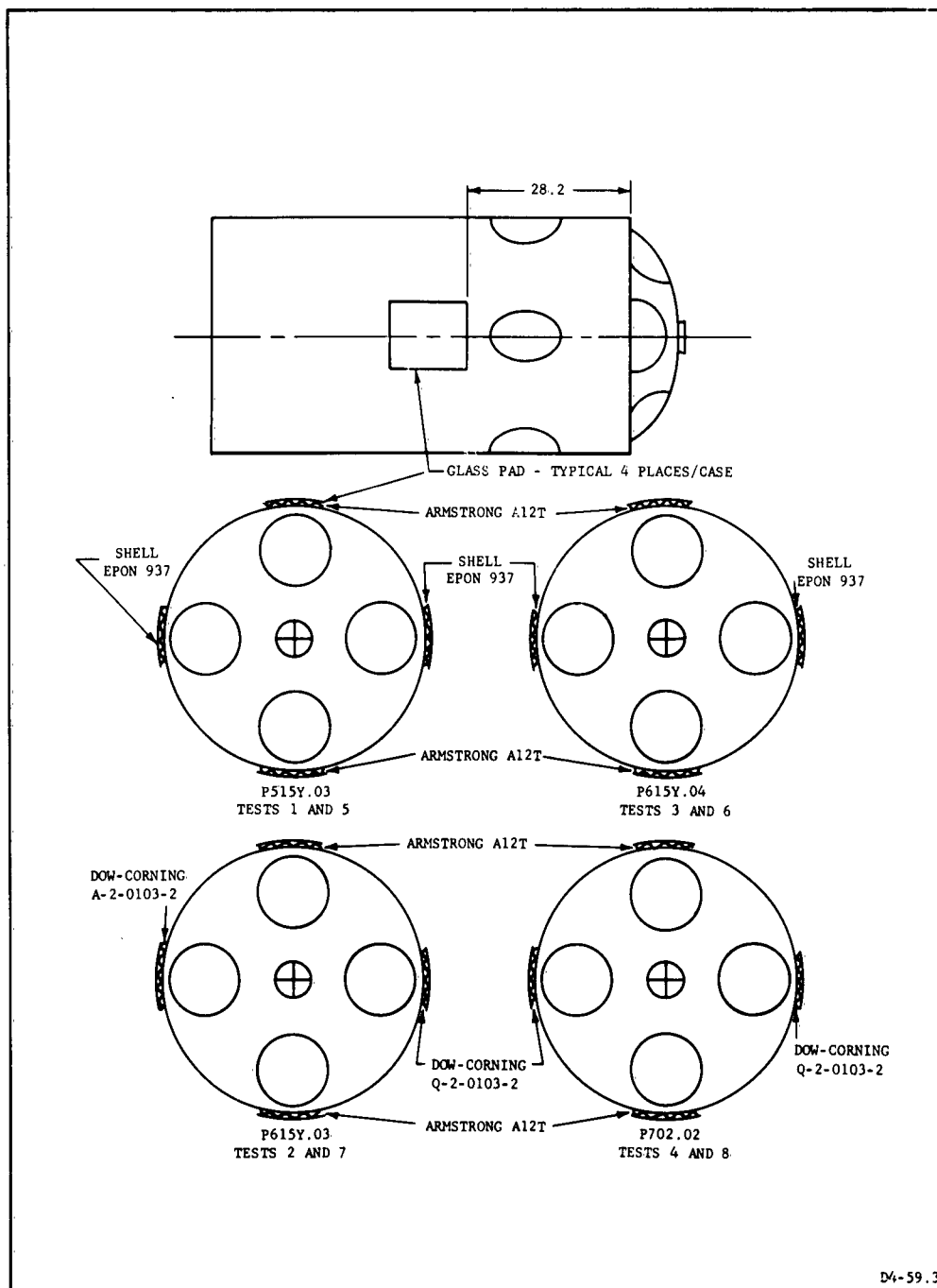


Figure 4. Glass Pad Placement on Case



f. Allow the adhesive to cure at ambient temperature (minimum of 70° F) for 10 hr before disturbing.

g. Approximately 750 to 800 grams of adhesive will be required.

#### E. TEST PROCEDURE

##### 1. Instrumentation

Apply instrumentation to the glass pads adjacent to TT ports 1 and 4 as shown in Figure 5. The remaining two pads do not need instrumentation.

##### 2. Calibration

Calibrate and perform all necessary instrumentation checkouts after the case has been filled with water.

##### 3. Internal Pressurization

Apply internal pressure in accordance with Figure 6.

##### 4. Heat Application

Apply heat when applicable. (See Figure 7.) Cases P615Y.04 and P702.02 will require external heating.

#### Note

After each pressure and temperature cycle, visually inspect the case for bond line and pad damage.

#### F. REPRESENTATION

Case Design Group representatives and Wing VI project office personnel will witness all testing.

#### G. DATA REDUCTION

Raw data will be collected at time of test by the Case Design Group (9524).

#### H. REPORTING

A quick-look memo will be distributed by the Case Design Group within five working days after completion of the first sequence of tests. A formal final report will be published within 30 working days after completion of the tests.

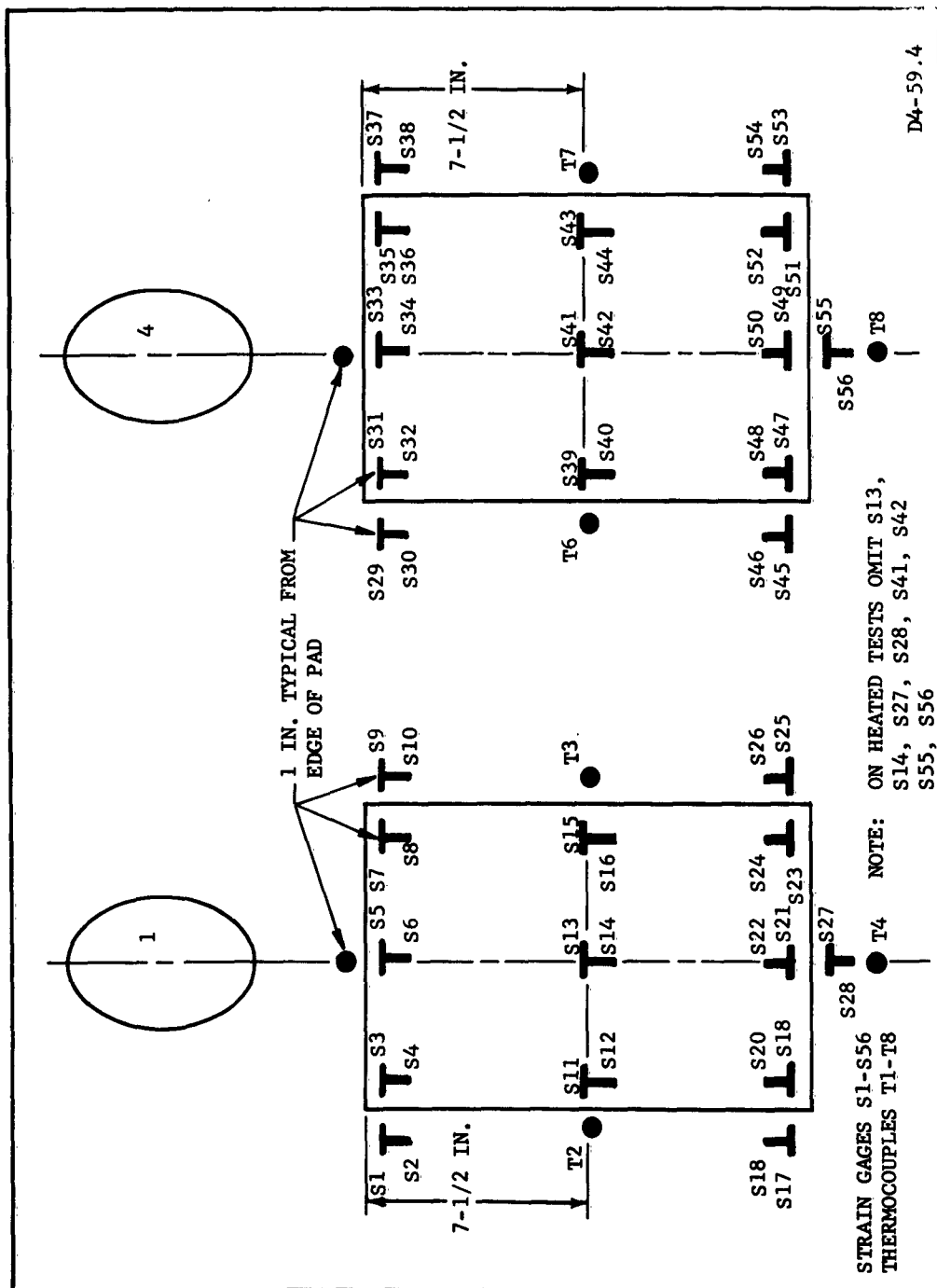
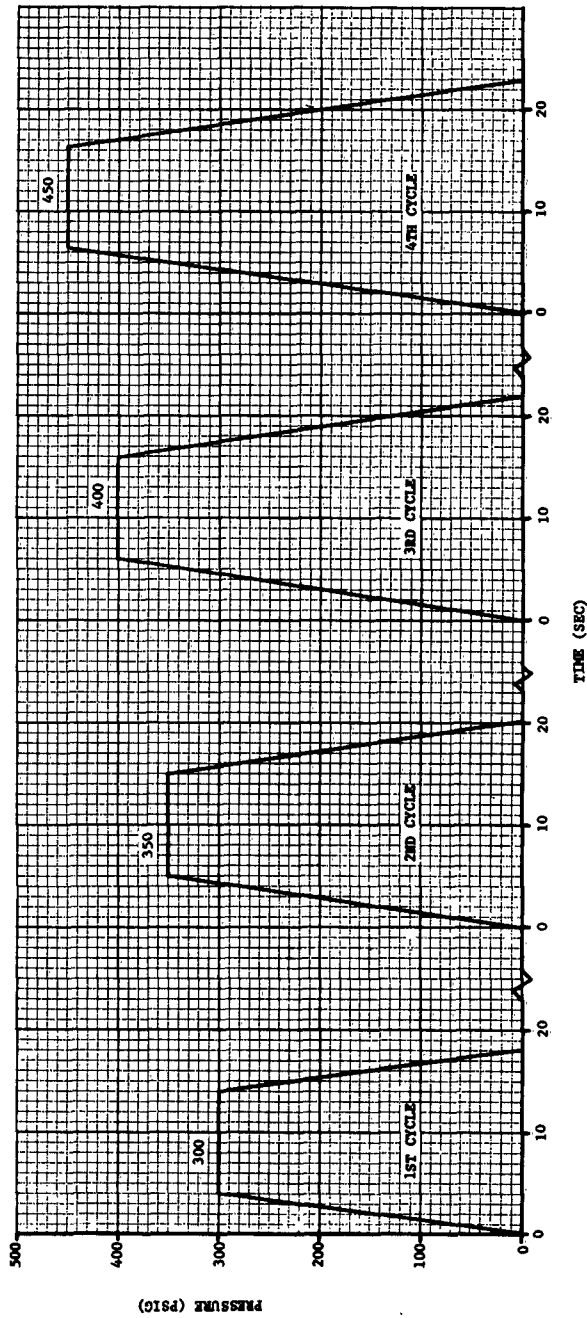


Figure 5. Instrumentation Layout



NOTE: ALL PRESSURE RATES ARE  
70 PSI/SEC

D4-59.5

Figure 6. Pressure vs Time

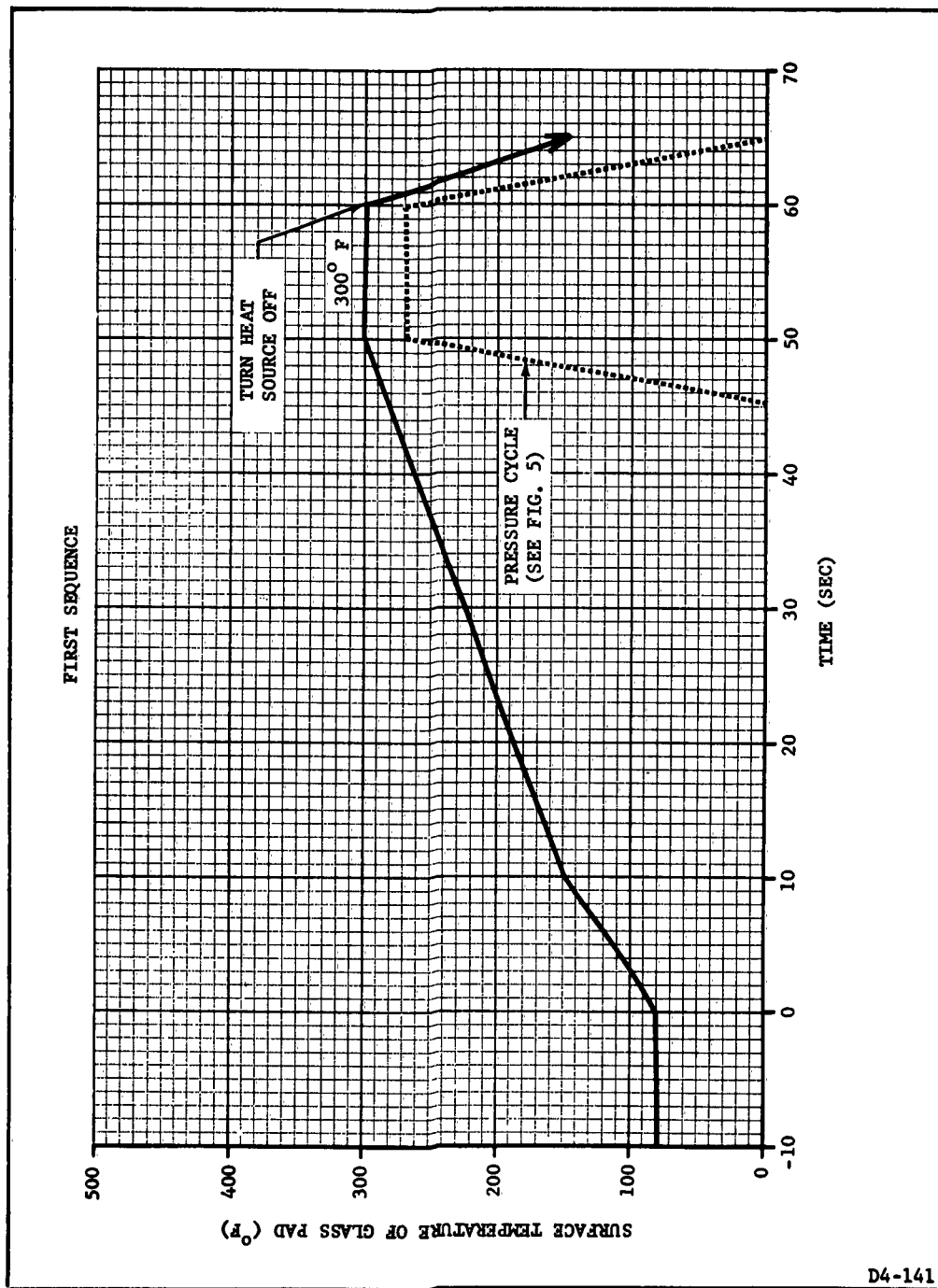


Figure 7. Temperature Data

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## TEST PLAN FOR EVALUATION OF PHASE I RTS ATTACHMENT BOND SYSTEM

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